Drinking Water Surveillance Program Summary Report for 2000, 2001 and 2002

The Drinking Water Surveillance Program (DWSP) is a voluntary program operated by the Ministry of the Environment (MOE) in cooperation with municipalities to gather scientific data on drinking water quality in Ontario. From 2000 to the end of 2002, 179 municipal drinking-water systems were collecting samples for the program. Laboratory analyses are provided by the MOE and the Ministry of Labour.

Summaries and detailed reports for the 179 municipal drinking-water systems that were monitored from 2000 to 2002 are provided on this web site as part of the Ontario government's commitment to make information about drinking water readily available to the public. Results showed that 99.8 percent of the tests performed for chemical, physical and radiological parameters in treated drinking water and water in the distribution systems indicated non-adverse water quality conditions. Tests for microbiological organisms, such as *Escherichia coli* (*E. coli*), are performed routinely by each drinking-water system and were not monitored by the DWSP.

Over 555,300 inorganic, organic and radiological tests were performed on raw water, treated drinking water and water in the distribution systems. Of the over 121,700 tests for chemical, physical and radiological parameters in treated drinking water and water in the distribution systems, over 121,500 test results met the health-related Ontario Drinking Water Objectives / Standards. One hundred and ninety test results exceeded a health-related objective / standard. The health-related objective / standard for atrazine plus N-dealkylated metabolites, chloramines, fluoride, lead, N–nitrosodimethylamine (N D M A), nitrates, selenium, total trihalomethanes, and turbidity were exceeded on at least one occasion at 35 municipal drinking-water systems for the 2000 to 2002 monitoring period. In addition, of the 3,950 tests reported for free and combined chlorine residuals, over 3,930 test results were above the minimum criteria for disinfectant residuals. Sixteen test results, at 9 municipal drinking-water systems, were below the minimum criteria for disinfectant residuals resulting in adverse water quality. For more information on these parameters, see the DWSP parameter groups section of this report.

The Ministry of the Environment has developed new rules to ensure that information about drinking water testing is disclosed to the public on a regular basis. These new rules came into effect on August 26, 2000 with the implementation of the Drinking Water Protection Regulation for Larger Waterworks (O. Reg. 459/00). As of June 1, 2003, under the Safe Drinking Water Act, the Drinking-Water Systems Regulation (O. Reg. 170/03) came into effect superceding O. Reg. 459/00.

Prior to O. Reg. 459/00, standard DWSP practice was to inform the operating authority and the MOE district manager with a DWSP 'Alert Notification' when a health-related

objective was exceeded. It was the responsibility of the operating authority to address the issue and to notify the local Medical Officer of Health. DWSP analytical results were also sent to the operating authority when the analyses were completed.

The Drinking-Water Systems Regulation stipulates that the owner of a water treatment or distribution system is required to ensure that notice is given to the local Medical Officer of Health and to the MOE if a parameter does not meet the Maximum Acceptable Concentration (MAC) or Interim Maximum Acceptable Concentration (IMAC) of the Ontario Drinking Water Quality Standards (ODWQS) (O. Reg. 169/03), or if a test result indicates adverse water quality. The Medical Officer of Health, through the Health Protection and Promotion Act (Chapter 10, Part 3, Sections 10, 11, 12, 13) has the authority to judge if drinking water is safe for human consumption.

ODWQS are the provincial standards of drinking water quality, most of which have been adopted from the Canadian drinking water quality guidelines established by the Federal-Provincial-Territorial Committee on Drinking Water. The guidelines are derived from risk assessment based exposure limits as modified by a risk management process incorporating review of the geographic scope and prevalence of the contaminant, available technology to remove it and associated costs. Select here for more information on the technical or scientific supporting documentation used by the Federal-Provincial-Territorial Committee on Drinking Water in developing and approving guidelines for contaminants found in drinking water. Several provinces, including Ontario, also set unique limits for parameters specific to their provincial drinking water quality. As a matter of clarification of terms, between August 2000 to June 2003, the ODWQS were known as the ODWS (Ontario Drinking Water Standards); prior to August 2000, they were known as the ODWO (Ontario Drinking Water Objectives).

Comprehensive compliance inspections are performed annually by the MOE at all municipal drinking-water systems. Where necessary, MOE staff issue Provincial Officer Orders that direct owners and operators of municipal drinking-water systems as to what must be done to bring their supplies into compliance. Ministry staff follow up to ensure compliance with all Orders.

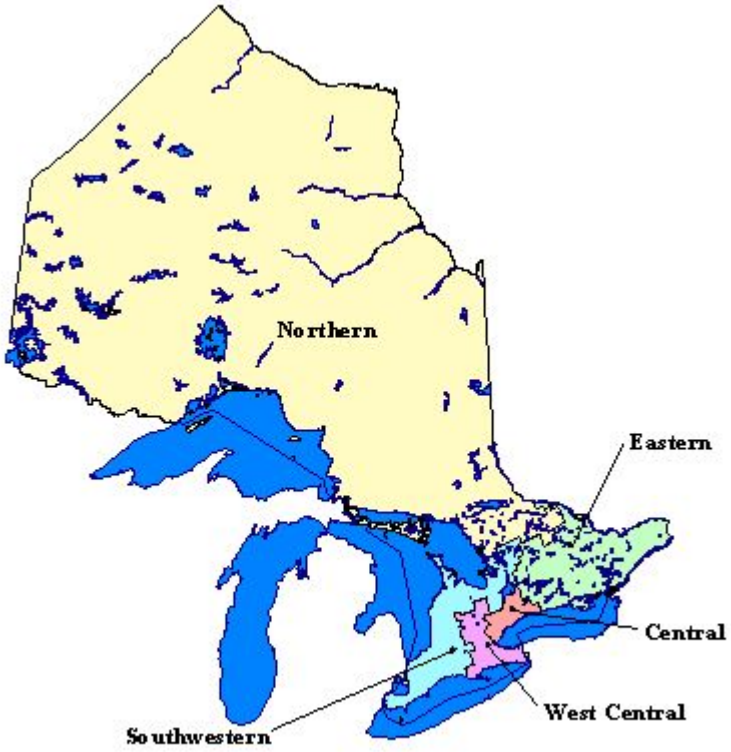
For further information on drinking water testing done by individual municipalities as required by the Drinking-Water Systems Regulation, including drinking water annual reports, readers are urged to contact the municipality.

Select here for background information on the DWSP, including information about parameters that are monitored by the program.

Select here for a summary of test results from each drinking-water system. [Printable version of Table A in PDF format]

Select here for a summary of test results from each drinking-water system. [Printable version of Table B in PDF format]

For a complete set of water quality data from individual drinking-water systems, choose a location on the list beside the map.



Regions:

- Central Region
- Eastern Region
- Northern Region
- South West Region
- West Central Region

Drinking Water Surveillance Program (DWSP)

Background Information

The DWSP is a scientific monitoring program developed by the MOE to provide information on municipal drinking water at selected municipal water treatment plants in Ontario. Collected data are used to:

- provide data in support of drinking water standards setting;
- monitor levels of chemicals and establish trends;
- define and track the occurrence of new chemicals;
- assess treatment plant operations; and
- assess and report on the state of Ontario's drinking water.

Drinking-water systems are invited to join the program on a voluntary basis depending on factors such as population served, geographical location, and risk of contamination. The

DWSP data are routinely provided to the municipality once the laboratory has completed the analyses.

The DWSP is not a compliance monitoring program. Ensuring compliance with the ODWQS is the responsibility of the owner or operating authority for each municipal drinking-water system, which is required to monitor and report the quality of the drinking water provided to the consumer and ensure its safety. Microbiological tests, such as *Escherichia coli* (*E. coli*), are performed routinely by each drinking-water system.

Drinking Water Characteristics

In Ontario, drinking water sources include rivers, lakes, streams, ponds, reservoirs, springs and wells. As water travels through the ground or over the surface, it dissolves naturally occurring minerals and radioactive material and can absorb substances resulting from the presence of animals or human activity.

Categories of substances that may be present in source waters include:

- Microbiological organisms, such as bacteria and viruses, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife.
- Inorganic substances, such as salts and metals, which can be naturally occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, farming, or domestic plumbing
- Synthetic and volatile organic substances, by-products of industrial processes and petroleum production which can come from gas stations, urban storm water runoff, old landfill sites and septic systems.
- Pesticides and herbicides which may come from a variety of sources such as agriculture, storm water runoff and residential use.
- Radioactive materials which can occur naturally or result from nuclear power production and mining activities.
- Disinfection by-products that are not found in source waters but are produced as a function of the disinfection treatment process.

DWSP Parameter Groups

Inorganic Parameters

Physical Parameters

Physical parameters are important to the efficient operation of the treatment plant. Six parameters were measured at the time of sampling and reported to the DWSP as field results. Of these 6 parameters, 2 have health-related ODWO / ODWS and 2 are indicators of adverse water quality. On occasion, the health-related standards for turbidity and chloramines were exceeded and the indicators of adverse water quality for minimum free chlorine residual and minimum combined chlorine residual were not met.

Turbidity in water is caused by the presence of suspended matter such as clay, silt and microscopic organisms and is commonly present in the source water as a result of soil runoff. The substances and particles that cause turbidity can be responsible for significant interference with disinfection, can be a source of disease-causing organisms and can shield pathogenic organisms from the disinfection process. Turbidity is an important indicator of treatment efficiency and the efficiency of filters in particular. In situations where *Giardia* cysts and *Cryptosporidium* oocysts are present in the source water, a significant relationship has been demonstrated between spikes in turbidity and the number of *Giardia* cysts and *Cryptosporidium* oocysts breaking through filters.

The Drinking-Water Systems Regulation prescribes turbidity as an adverse result if the drinking-water system is required to provide filtration, and a result indicates that turbidity exceeds 1 Nephelometric Turbidity Units (N T U) in either a grab sample of water taken from each individual filter effluent line, or the latter of two samples of water from each individual filter effluent line taken 15 minutes apart and tested by continuous monitoring equipment. An aesthetic objective of 5 N T U has been established for turbidity and this objective is applicable to all water at the point of consumption. However, the health-related objective / standard for turbidity of 1 NTU, during the 2000 to 2002 monitoring period, applied to treated and distributed drinking water rather than filter effluent.

Field turbidity measurements were recorded at the time of sampling by plant personnel and were entered into the DWSP data base. Turbidity was also measured at the MOE laboratory within 48 hours of receiving the sample. Because of this time delay the laboratory measurement is not considered as reliable as the field measurement.

Turbidity in ground water samples can increase if the samples are not measured immediately in the field. This increase is frequently caused by precipitation of iron, calcium or sulphide. The field turbidity measurement should always be used in place of the laboratory result.

A total of 1,336 tests were reported for field turbidity. Ten municipal drinking-water systems reported a total of 43 tests exceeding the ODWO / ODWS of 1 N T U for water entering the distribution system. A total of 1,199 samples were analysed for lab turbidity. The results from 3 municipal drinking-water systems indicated that 3 tests exceeded the ODWO / ODWS of 1 N T U.

Chloramines (Combined Chlorine) are produced during the disinfection process when aqueous chlorine and ammonia are mixed. Chloramine is an alternative disinfectant and can be used to maintain a chlorine residual for long periods of time in the distribution system. Chloramines assist in the control of certain taste and odour problems caused by chlorination and restrict the formation of disinfection by-products including trihalomethanes. A total of 1,942 tests were reported for chloramines. Two municipal drinking-water systems reported a total of 5 tests exceeding the ODWO / ODWS of 3 milligrams per litre (parts per million).

Chlorine residual in water is a component of chlorine after the initial disinfection or chlorine demand has been satisfied. The chlorine residual concentration is often expressed in terms of free chlorine, total chlorine, or combined chlorine (chloramine). The maintenance of a chlorine residual in the distribution system is intended to keep a persistent disinfectant residual to protect the water from microbiological re-contamination and serve as an indicator of distribution system integrity (loss of disinfectant residual indicating that the system integrity has been compromised).

For drinking-water systems using free chlorine as the method of disinfection, an adverse water quality condition is deemed to occur when the *free chlorine residual*, in a distribution sample, is less than 0.05 milligrams per litre (parts per million) as prescribed in the Drinking-Water Systems Regulation and in the former Drinking Water Protection Regulation. For systems using chloramination, a *combined chlorine residual* of less than 0.25 milligrams per litre (parts per million) in a distribution sample is considered an adverse result. Prior to O. Reg. 459/00 (August 26, 2000), adverse water quality was not based on low chlorine residuals.

A total of 2,008 tests were reported for free chlorine residual. Eight municipal drinking-water systems reported a total of 15 tests below 0.05 milligrams per litre (parts per million). A total of 1,942 tests were reported for combined chlorine residual. One municipal drinking-water system reported 1 test below 0.25 milligrams per litre (parts per million).

Chemical Parameters

Some chemical parameters are naturally occurring in the source water. The water treatment process is designed to reduce the levels of some of these parameters. There are 31 parameters included in this group, of which 5 have health-related ODWO / ODWS. On occasion, the health-related objective / standard for fluoride and nitrates were exceeded.

Fluoride is a chemical substance that may be added to municipal water during the treatment process to promote strong teeth. Fluoride can also be present in the source water as a result of erosion of natural deposits or discharge from fertilizer and aluminum factories. Where natural levels of fluoride are measured between 1.5 milligrams per litre (parts per million) and 2.4 milligrams per litre (parts per million), public and professional awareness is promoted to control excessive exposure to fluoride from other sources. A total of 1,578 samples were analysed for fluoride. The results from 4 municipal drinking-water systems indicated that 19 tests exceeded the ODWO / ODWS of 1.5 milligrams per litre (parts per million).

Nitrate is present in source water as a result of run-off from fertilizer use, leaching from septic tanks, sewage and erosion from natural deposits. A total of 1,572 samples were analysed for nitrate. The results from 2 municipal drinking-water systems indicated that 2 tests exceeded the ODWO / ODWS of 10 milligrams per litre (parts per million).

Metals

Metals are naturally present in source water, or are the result of industrial activity. Some metals, such as copper, zinc, nickel and lead, may leach into the drinking water from the distribution system and from domestic plumbing. There are 23 parameters included in this group, of which 6 have health-related ODWO / ODWS. On occasion, the health-related objective / standard for lead and selenium were exceeded.

Lead can occur in source water as a result of erosion of natural deposits. The most common source of lead is corrosion of household plumbing. First flush water at the consumer's tap may contain higher concentrations of lead than water that has been flushed for several minutes. The ODWO / ODWS recommends that only the cold water supply be used for consumption and only after five minutes of flushing to clear the system of standing water. A total of 2,522 samples were analysed for lead. The results from 2 municipal drinking-water systems indicated that 3 tests exceeded the ODWO / ODWS of 10 micrograms per litre (parts per billion).

Selenium occurs naturally in water at trace levels as a result of geochemical processes such as weathering of rocks and soil erosion. It is difficult to establish levels of selenium that can be considered toxic because of the complex interrelationships between selenium and dietary constituents such as protein, vitamin E, and other trace elements. Selenium is an essential trace element in the human diet. A total of 2,513 samples were analysed for selenium. The results from 2 municipal drinking-water systems indicated that 43 tests exceeded the ODWO / ODWS of 10 micrograms per litre (parts per billion).

Organic Parameters

Organic chemicals make up 83% of the total number of parameters tested by the DWSP. Organic chemical parameters are grouped accordingly:

Chloroaromatics

Parameters classified as *chloroaromatics* are present in surface water as a result of industrial activity. They are by-products of certain industrial processes of chlorination of hydrocarbons. There are 15 parameters included in this group, of which none have health-related ODWO / ODWS. A total of 908 samples were analysed for chloroaromatics.

Chlorophenols

There are 7 specific *chlorophenols* reported in this group, of which 4 have health-related ODWO / ODWS. The results from a total of 930 samples analysed indicated that no chlorophenols exceeded the health-related ODWO / ODWS.

Dioxins and Furans

Dioxins and Furans are chlorinated hydrocarbons that occur as by-products and are formed in very small amounts in combustion processes, particularly of chlorinated materials, and in some poorly controlled industrial processes such as bleached paper

manufacturing. Dioxins and furans are not routinely tested in drinking water. However, a limited number of samples, from selected drinking-water systems, were analyzed by the DWSP to obtain information and examine trends. The results from a total of 47 samples analysed indicated that no dioxins or furans were detected.

N-nitrosodimethylamine (N D M A)

N-nitrosodimethylamine (N D M A) or precursors that cause the formation of N D M A may be present in the source water as a result of industrial discharge or from sewage/animal waste effluents combined with nitrite from anaerobic decay of organic waste matter. N D M A has been detected as a by-product in certain blends of coagulant and polymer used in the treatment process. Three additional N-nitroso-amine compounds, N-nitrosodibutylamine, –nitrosodiethylamine and N-nitrosomorpholine are included in this group. A total of 1,021 samples were analysed for N D M A. The results from 5 municipal drinking-water systems indicated that 23 tests exceeded the ODWO / ODWS of 9 nanograms per litre (parts per trillion).

Polynuclear Aromatic Hydrocarbons (P A H)

The presence of Polynuclear Aromatic Hydrocarbons (P A H) in the environment is principally associated with the combustion of organic matter, including fossil fuels. There are 15 parameters included in this group, of which 1 has a health-related ODWO / ODWS. The results from a total of 350 samples analysed indicated that no P A H exceeded the health-related ODWO / ODWS.

Polychlorinated Biphenyls (P C B)

Polychlorinated Biphenyls (P C B), in the past, have been marketed extensively for a wide variety of purposes but are no longer manufactured or used. The results from a total of 908 samples analysed indicated that no P C B exceeded the health-related ODWO / ODWS.

Pesticides / Herbicides

There are 93 parameters included in this group, of which 53 have health-related ODWO / ODWS. On occasion, the health-related objective / standard for atrazine plus N-dealkylated metabolites was exceeded.

Atrazine is the pesticide most commonly detected in Ontario’s municipal drinking water. The presence of atrazine and other pesticides at trace levels indicates that the raw water source is affected by agricultural activity. A total of 1,641 samples were analysed for atrazine and the metabolite dealkylated atrazine. The results from 1 municipal drinking-water system indicated that 2 tests exceeded the ODWO / ODWS of 5,000 nanograms per litre (parts per trillion).

Taste -and Odour- Causing Parameters

Taste and odour episodes in drinking water have become more prevalent in Ontario over the past several years. They are caused by the decomposition of blue-green algae and generally occur after the algae blooms in the late summer. The compounds most frequently associated with taste and odour are Geosmin and 2-methylisoborneol (2-M I B). Although geosmin and 2-M I B can impart nuisance taste and odour at very low levels, no health-related or aesthetic guidelines have been established. There are 6 parameters included in this group, of which none have health-related ODWO / ODWS.

Geosmin and 2-M I B are now monitored routinely under the DWSP. A total of 1,119 samples were analysed for geosmin and 2-M I B. Special surveys can also be conducted at selected locations during specific times of the year. Many drinking-water systems have now installed granular activated carbon filters to the treatment process to decrease the effect and intensity of these taste and odour events.

Volatile Organic Parameters

Volatile organic parameters are generally present in source water as a result of recreational or industrial activity. There are 27 parameters included in this group, of which 11 have health-related ODWO / ODWS. One additional compound, methyl tert-butyl ether (M T B E), was added to this group. With the exception of disinfection by-products, which are discussed below, tests indicated that no results reported for volatile organic parameters exceeded the health-related ODWO / ODWS.

Disinfection By-products

Trihalomethanes (T H M) are by-products of chlorination, which may occur during the water treatment process. Trihalomethanes are comprised of bromoform, chloroform, bromodichloromethane and chlorodibromomethane. Compliance with the total trihalomethane health-related standard is calculated on the basis of a running annual average of four quarterly test results from the distribution system.

A total of 1,357 samples were analysed for trihalomethanes. The results from 12 municipal drinking-water systems indicated that the ODWO / ODWS criteria of 100 micrograms per litre (parts per billion) for total T H M was exceeded on 47 occasions.

Haloacetic Acids (H A A) are another category of disinfection by-products which may occur during the water treatment process. Haloacetic acids are comprised of monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, bromochloroacetic acid, and dibromoacetic acid. 2,2-dichloropropanoic acid has been added to this group. Results are reported for the individual compounds as well as for total H A A. A total of 1,281 samples were analysed for H A A. There is presently no health-related ODWO / ODWS for H A A.

Radiological Parameters

Radionuclides

There are more than 200 radionuclides, some which occur naturally and others which originate from the activities of society. The radionuclide of concern in Ontario drinking water supplies is tritium. Surrogate measurements, such as gross alpha emission and gross beta emission, are preliminary screens for all radionuclides. Tritium, a gross beta emitter, must be measured separately because the screening process is not sufficiently sensitive to detect low levels of tritium. The results from a total of 479 samples analysed indicated that no tritium exceeded the health-related ODWO / ODWS of 7,000 Becquerels per litre.

Conclusions

One hundred and seventy nine municipalities were monitored by the Drinking Water Surveillance Program from 2000 to 2002. A total of 99.8 percent of the test results for chemical, physical and radiological parameters in treated drinking water and water in the distribution systems indicated non-adverse water quality conditions.
